

## SOCK

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is based upon patent application PCT/DE 2004/000023 filed January 13, 2004, International Publication No. WO2004/064551.

BACKGROUND OF THE INVENTION

[0002] The invention relates to a sock, in particular for use in athletic activities.

[0003] Human feet are often accommodated in tight shoes. This is the case in particular when the person moves quickly and a lot, e.g., in athletic activities. The tight shoes themselves result in increased perspiration on the feet. During athletic activity such a person will experience above-average perspiration. Since the risk of the development of blisters on the foot is increased due to the accumulation of perspiration in the shoe and/or sock, there have been attempts to facilitate the removable of perspiration from the shoe and/or sock.

[0004] German Utility Model DE 297 15 762 U1 discloses a climate-regulating stocking, in particular for use in types of leisure activities such as jogging, inline skating, skiing or the like, having at least one integrated air channel made of a climate-regulating mesh knit fabric extending from the sole of the foot to the band at the top. The climate channel allows most of the moisture generated to evaporate by conveying the moisture of perspiration out of the tread area of the foot and into an area of the stocking where free evaporation is possible. The known climate-regulating stocking fulfills all the requirements made of it.

[0005] The object of the present invention is to further improve upon the removal of moisture from the shoe. According to this invention, this object is

achieved by providing at least one climate channel in the tread area.

[0006] This invention creates a sock, in particular for athletic activities, which further improves upon the removal of perspiration from the shoe and/or sock. By providing a climate channel in the tread area, it is possible to promote the conveying of the moisture that occurs in the area of the sole of the foot directly out of the area of the sole of the foot via the climate channel. The moisture can then escape through ventilation holes in the shoe.

[0007] In a further embodiment of this invention, the tread area of the sock has a central climate channel with additional climate channels branching off from it to the outer area of the sock. This achieves a uniform climate in the tread area. Furthermore, an equalization of pressure between the channels is achieved, resulting in a uniform removal of moisture under load. In addition, a pleasant feeling of occurrence is induced with the tread.

[0008] In an embodiment of this invention, the climate channel has a bent or wavy pattern. This enlarges the effective channel length, which results in an increase in the transport capacity while also increasing the surface area available for cooling in the tread area.

[0009] In another embodiment of this invention, the channels in the tread area are designed with a constriction. Due to the partial tapering of the channel path, accelerated air guidance is achieved, which in turn accelerates the removal of moisture out of the tread area and causes an increase in the cooling power in this area.

[0010] In another embodiment of this invention, an air channel is provided optionally on the inside and/or outside of the leg of the sock and this air channel is connected to the climate channel in the tread area. This provides an additional path for removing perspiration from the tread area of the foot. In the case of air channels on the inside of the leg and the outside of the leg, an additional air circulation in the shoe is achieved through the connection of the air channels.

[0011] In another embodiment of this invention, the sock has cushions. The cushions may be provided at different locations in the sock. They reduce skin abrasion as well as the risk of pressure points developing on the foot.

[0012] The sock is advantageously equipped with an X-cross bandage. The X-cross bandage supports the ankle in the transition area between the leg and the foot.

[0013] Other embodiments and improvements on this invention are described below.

#### BRIEF DESCRIPTION OF THE DRAWING

[0014] An exemplary embodiment of this invention is depicted in the drawing and is described in greater detail below. Like numerals refer to like elements in the various views.

[0015] Figure 1 shows a diagram of a sock with a lateral air channel, X-cross bandage and cushions in a side view.

[0016] Figure 2 shows a diagram of the tread area of the sock with a curved conveyance channel;

[0017] Figure 3 shows a diagram of the tread area of the sock with a wavy conveyance channel;

[0018] Figure 4 shows a diagram of the sock illustrated in Figure 3 as seen in a side view;

[0019] Figure 5 shows a diagram of the tread area of the sock with a narrowed conveyance channel;

[0020] Figure 6 shows a section along line VI-VI in Figure 5;

[0021] Figure 7 shows a diagram of the tread area of the sock with a central conveyance channel;

[0022] Figure 8 shows a diagram of the tread area of the sock with an additional air channel on the inside of the leg;

[0023] Figure 9 shows a diagram of the tread area of the sock with an additional air channel on the outside of the leg; and

[0024] Figure 10 shows a diagram of the tread area of the sock with an additional air channel on the inside of the leg and on the outside of the leg.

DETAILED DESCRIPTION OF THE INVENTION

[0025] The sock selected as an exemplary embodiment (Figure 1) consists of a foot part 1 and a shaft 2. The foot part 1 has a toe area 11, a heel area 12 and a tread area 13 situated between the toe area and the heel area. The areas 11, 12 and 13 may be made of a reinforced material, as illustrated in the exemplary embodiment. The use of combinations of materials such as sheared wool with elastic fiber materials such as Elastan is also possible. It is also possible to provide additional cushions or padding in the areas mentioned above.

[0026] The shaft 2 is provided with a band 21 on the end facing away from the foot part 1. In the area of the calf, the shaft 2 is provided with padding 22, with bar padding being provided in the example shown here. Other forms of cushioning are also possible. Padding 23 is also provided in the lower area of the ankle developing into the arch of the foot. The arrangement of padding may also be provided in the area of the Achilles tendon.

[0027] The padding is usually made of synthetic yarns or compound fabrics or yarn or similar materials. In the exemplary embodiment, the padding in the socks is made of hollow chamber fibers spun with wool or cotton on the outside. The hollow chamber synthetic fiber yarns are especially highly shock absorbing and pressure absorbing. The tread area 13 may be made of a microfiber knit that helps to reduce abrasion. Depending on the requirements, the foot bed may also be made of microfibers in the area of the toes and heel.

[0028] In addition, the sock is equipped with an X-cross bandage 24 which is made of an elastic climate-regulating fabric. The X-cross bandage 24 supports the ankle in the transition area between the leg and the foot.

[0029] In the exemplary embodiment, an air channel 25 extends from the band 21 into the tread area 13 and is made of a climate-regulating mesh knit fabric. The air channel 25 contributes toward removal of the moisture from the tread area upward. Such an air channel 25 may also be provided on the sock on the inside of the leg or on both sides.

[0030] In tread area 13 of the sock, at least one climate channel 26 is provided. In the exemplary embodiment according to Figure 2, three climate channels 26 are provided. The tread area 13 is interrupted by the climate channels 26. The climate channels 26 begin and end on the outside of the tread area and are designed with a curvature so that the effective channel length is increased. This effect is further increased by the wavy design of the climate channel in the exemplary embodiment according to Figure 3. By enlarging the effective channel length, the transport capacity is increased and the cooling surface area in the tread area is increased. As shown in Figure 4, the climate channels 26 may run throughout the entire (reinforced) tread area 13 of the sock so they may also extend into the lateral areas enclosing the foot. The climate channels 26 are made of a climate-regulating mesh knit fabric. They may be designed so that the thickness of the mesh knit fabric corresponds to the thickness of the tread area so as to form a continuous surface. This has a positive influence on wearing comfort.

[0031] In the exemplary embodiment according to Figure 5, the climate channels 26 are designed with a constriction in the tread area 13 of the sock. Due to the partial taper 261 in the climate channel 26, acceleration of the air guidance is achieved (so-called Venturi principle). This accelerates the removal of moisture out of the tread area 13 while also increasing the cooling capacity in this area. This advantage may be further reinforced by the fact that the climate channels 26 have an essentially circular cross section (Figure 6). In this embodiment, the taper 261 also has an approximately circular cross section. The section of the channel 26 that is not closed is labeled as "b." Under load, the distance b is reduced in the extreme case to  $b = 0$ , resulting in a closed circular cross section. The climate channel 26 is then in the form of a Laval nozzle, further improving the positive properties.

[0032] In the exemplary embodiment according to Figure 7, a central channel 262 is arranged on the longitudinal central axis of the tread area 13 with curved climate channels 26 branching off on both sides and ending on the outside edge of the tread area 13. Due to the central connection of the climate channels 26 through the central channel 262, a uniform climate is achieved over the tread area 13. In addition, the connection produces a uniform pressure in all climate channels 26 so that a uniform moisture removal under load is achieved. In addition the uniform pressure results in a pleasant tread feeling. In a modification of the exemplary embodiment, there is the possibility of extending the central channel 262 beyond the tread area 13 into the toe area 11 and/or the heel area 12.

[0033] In the exemplary embodiment according to Figure 8, an air channel 25 is provided on the inside of the leg. The air channel 25 extends into the arch of the foot. At the transition from the arch of the foot to the tread area 13 of the sock, the climate channels taper out, arranged in a radiating pattern. Due to this arrangement, wide areas of the tread area are reached by the climate channels 26 so that it is possible to remove moisture out of the entire tread area. The width and length of the climate channels 26 can usually be selected freely. The number of climate channels 26 is also variable. By increasing the length and/or width of the

climate channels 26 or increasing the number of climate channels 26, an increase in the moisture that can be conveyed is also possible.

[0034] In the exemplary embodiment according to Figure 9, an air channel 25 is provided as an equivalent on the outside of the leg, with the three climate channels 26 leading away from it. The climate channels radiate outward into the area of the arch of the foot.

[0035] In the exemplary embodiment according to Fig. 10, an air channel 25 is provided on the inside of the leg of the sock and on the outside of the leg of the sock. The climate channels 26 run between the air channels on the inside of the leg and those on the outside of the leg. The number and dimensions of the climate channels can be selected essentially freely here. With the connection of the air channels 25 on the inside of the leg and on the outside of the leg, optimum air circulation is provided in the shoe, so that a maximum of atmospheric humidity can be transported out of the shoe and/or the sock.

[0036] In addition to the exemplary embodiments depicted in the figures, there are also other possibilities for the distribution and orientation of the climate channels 26. For example with the exemplary embodiments according to Figures 8, 9 and 10, it is possible for the climate channels to run into the area of the tip of the foot and/or the heel. When speaking of socks in the description and claims, this invention is not limited only to socks but instead this term also includes stockings, pantyhose and the like to which this invention also refers.